



MANUAL

v. 1.1

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1. INTRODUCTION

Behringer's Poly D analogue synthesizer was conceived as an affordable alternative to the Minimoog Model D. Although heavily based on its predecessor, the Poly D comes with some additional features, such as a paraphonic mode, a 32-step sequencer, as well as a chorus and a distortion effect.

Since its release in 2019, the Poly D has become one of Behringer's most popular products. Given its popularity and affordability, I imagine that the Poly D is many people's first analogue synth. This, coupled with the fact that Behringer's own Quick Start Guide leaves a lot to be desired, suggests that a large number of Poly D users could benefit from a comprehensive guide to the synthesizer. I think there's a need for a manual that not only explains the ins and outs of the synth itself, but one that also introduces the basics of analogue synthesis for newcomers.

In this manual, I've tried to break down the parts of the Poly D according to their function. Each chapter deals with a concept, such as the oscillator banks, or modulation, and explains how it works in an introductory fashion, using pictures of the different sections of the synth. In the final chapter, I've also included a list of links that Poly D users might find useful.

I wrote this manual partly to teach myself how the synth works, partly to share this information with others. My hope is that you learn something from the Manual and that you will let me know if there's anything that could be improved upon.

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2. OVERVIEW

In this chapter, I'll give a brief overview of the synthesizer and explain the structure of the manual.

The Poly D's interface consists of 9 different sections. These are: (1) the **CONTROLLERS** section, (2) the **OSCILLATOR BANK**, (3) the **MIXER** section, (4) the **FILTER** section, (5) the **DISTORTION** section, (6) the **CHORUS** section, (7) the **SEQUENCER** section, (8) the **OUTPUT** section, as well as (9) the **KEYBOARD** section.



The nine sections of the Poly D.

Let's give a short breakdown of how these sections relate to each other. In a nutshell, the **CONTROLLERS** section lets you control fundamental aspects of the synthesizer, such as global tuning, whether the synth should be in mono or poly mode, as well as the type of modulation you wish to use. Next, the **OSCILLATOR BANKS** generate the sound of the synth. This is where you configure the tuning,

octave range and wave shapes of the Poly D's four oscillators. The MIXER adjusts the levels of the oscillators, and lets you enable noise and external inputs as additional sound sources. In the FILTER section, you can edit the sound using the frequency filter and envelopes. In addition, you can add DISTORTION and CHORUS effects to your sound. The SEQUENCER and arpeggiator section lets you automate and program patterns. The OUTPUT section includes the master volume, headphone input, as well as the power switch. Finally, the KEYBOARD section mainly consists of a pitch wheel, a mod wheel, and the 37 keys.

This guide will not go through these sections numerically. Instead, the Manual proceeds thematically. I think that the most logical way is to start with the source of the sound, meaning the oscillators, before looking at how the filter and the envelopes shape the sound, and then go through modulation. Finally, I'll look at the distortion and chorus effects, after which I'll end the tour with the sequencer and arpeggiator.

3. OSCILLATORS

The Poly D comes with 4 separate **oscillators**. These are what create the sound of the synth. For each oscillator, you can adjust the pitch, its octave and the wave shape. For each key pressed, the synthesizer can have up to four oscillators playing at once. The **MIXER** is what determines the individual volume of each oscillator.

Let us take a closer look at what each of the controls in the **OSCILLATOR BANK** section does.



The OSCILLATOR BANK section.

Each oscillator is connected to a set of knobs. All the oscillators have a **frequency RANGE** knob, with six different ranges: **Lo**, **32'**, **16'**, **8'**, **4'** and **2'**. These refer to the different octaves, from lowest to highest. Next to the knob, there is also a LED which lights up when the oscillator is playing.



The RANGE knob of one the oscillators.

The set-up of the other knobs varies slightly with each oscillator. Oscillators 2-3 have a **FREQUENCY** adjustment knob, for fine-tuning the oscillators, with a range from -7 to +7 semitones. Slightly detuning oscillators from each other can create effective sounds. For example, tuning Oscillator 1 a tiny bit away from Oscillator 2 can create a broader sound than if they were completely in tune. A lot of the unique sound of an analogue synthesizer comes from this slightly detuned sound of the oscillators.



The FREQUENCY adjustment knob of Oscillator 2.

The **WAVEFORM** knobs let you select one of six different wave shapes for each oscillator. The wave shape of an oscillator is what gives it its unique sound.

The shapes for oscillators 1-3 include **triangle**, **triangle/sawtooth**, **sawtooth**, **square**, **medium pulse** and **narrow pulse**. For Oscillator 4, the triangle/sawtooth shape is replaced by the **reverse saw shape**.



The waveform knobs for Oscillators 3 and 4.

Let's have a quick look at how wave shapes affect the sound of the synth.

Different wave shapes have different qualities. Specifically, they differ in terms of **harmonics**. Each sound that we perceive as a note has a **fundamental frequency**. If I play a middle C on a piano, the fundamental frequency of that sound is what determines that it's a C. However, that C also comes with harmonics, which are frequencies which vibrate in multiples of the fundamental frequency. These additional frequencies are what make us hear a C played on the piano differently from a C played on the guitar; we say that the piano and the guitar have different *timbres*, or *tone colors*. This is because C on a piano and C on a guitar share the same fundamental frequency, but have different harmonics. The same is true of different wave shapes.

In total, the seven different wave shapes of the Poly D are:

- triangle
- triangle/sawtooth
- sawtooth
- square
- medium pulse
- narrow pulse
- reverse sawtooth

Let's briefly go through these and what their defining characteristics are.

TRIANGLE

The triangle shape rises in a diagonal direction, and then falls at the same angle in the other direction. This means that the rising and falling route of the shape is even, without any sharp turns.



It only includes odd harmonics, meaning that the harmonics are odd multiples of the fundamental frequency, such as x3, x5, x7, and so on. This is the wave shape of the Poly D with the least amount of harmonics. Because of this, the triangle is the wave shape that comes closest to a sine wave, which is a waveform without any harmonics, meaning that it only has a fundamental frequency. Because of the strong fundamental frequency of the triangle shape, it has a smooth, flute-like timbre which is well-suited for lead sounds.

SAWTOOTH

The sawtooth shape ascends – just like the triangle – in a diagonal direction but then descends sharply before it starts to ascend again. It resembles the shape of a saw's tooth. Because of this shape it is also sometimes called a **ramp up** shape.



The sawtooth is the buzziest of the wave shapes. This is because it's the richest in harmonics. It includes both even (such as x2, x4, and x6) and odd harmonics. The sound of the sawtooth is sometimes described as harsh, and is well-suited for fat, punchy basses, creamy leads or string-like sounds.

SQUARE

This wave shape rises up straight, stays flat and then falls straight down again, thus forming a square-like shape with a binary, or on/off movement.



Like the triangle shape, it only contains odd-numbered harmonics. But because the harmonics in the square wave are more prominent than in the triangle, the square is buzzier than the triangle, but still not as harsh as the sawtooth. The sound could be described as hollow, making it suitable for creating woodwind sounds, such as that of the clarinet.

It bears mentioning that the square wave is a particular type of **pulse wave**. In a square wave, the width of the wave is equal to its height. In other pulse waves, the width is shorter than the wave's height. The Poly D includes two additional such pulse waves: medium and narrow.

MEDIUM PULSE

A medium pulse wave has a shape where the width of the wave shape is not equal to its height. Instead, its height is taller than its width, thus making it slightly narrower.



This yields a sound which is more nasal than that of the square wave.

NARROW PULSE

A narrow pulse wave has a form whose height, in relation to its width, is even longer than the other pulse waves.



This makes the narrow pulse shape the buzziest of the pulse waves.

TRIANGLE/SAWTOOTH

This waveshape - also called trisaw and shark tooth - is a combination of the triangular and the sawtooth waveforms.



The triangle/sawtooth form retains the odd numbered harmonics of the triangle but adds in some additional even numbered harmonics of the sawtooth. This means that it has a richer harmonic texture than that of the triangle shape, but less so than the sawtooth.

REVERSE SAWTOOTH

The reverse sawtooth shape has the same form as the sawtooth, but mirrored.



When the regular sawtooth rises diagonally and then falls sharply, the reverse sawtooth rises sharply and then falls diagonally. Because of this, it's also called a **ramp up** shape, contrary to the sawtooth's **ramp down** shape.

Its sound is generally indistinguishable from that of the ordinary sawtooth; its practical utility is mainly meant for when using Oscillator 4 as a modulation source. The reverse sawtooth shape replaces the trisaw shape in that oscillator for this very reason. More will be said about this in the chapter on MODULATION.

Since the Poly D has four oscillators, you can combine and mix the different wave shapes together, thus creating even more exciting sounds than in their default settings. Seven different wave shapes spread out over four different oscillators makes for quite a rich palette!

OSCILLATOR 4 CONTROL

Connected to the fourth oscillator, there is an **OSC 4 CONTROL** switch. When switched **ON**, this lets you control Oscillator 4 in the default way with the keyboard. If we turn it **OFF**, however, the oscillator cannot be controlled by the keyboard, the pitch wheel, global tuning, or modulation wheel. Instead, it can either be used for playing a fixed note (e.g. for drones), or when set to **LO**, as a **low frequency oscillator (LFO)**. That is a topic for the chapter on MODULATION.

ADDITIONAL OSCILLATOR CONTROLS

In the CONTROLLERS section, there is a **TUNE** knob for **overall**, or **global, tuning**. This lets you tune the oscillators from -2.5 to +2.5 semitones. (Oscillator 4, however, is only affected if the OSC 4 CONTROL switch is ON.) The global tuning of the oscillators can also be adjusted with the **TRANSPOSE** function in the KEYBOARD section. This has three modes: **UP**, **NORM** and **DOWN**, which lets you transpose the whole keyboard up or down an octave.

The **PITCH WHEEL** - which is located in the KEYBOARD SECTION as well - can also be used to temporarily change the pitch of the note you're playing. The wheel is prepared with a spring so that it bounces back to the default position after it's released.

Finally, the **GLIDE** function (also called portamento) adjusts pitch insofar as it determines the amount of time it takes for the pitch to change from one note to the next. There is an **ON/OFF** switch in the KEYBOARD section, and the **amount** of glide is adjusted by turning the **GLIDE knob** in the CONTROLLERS section, with a value from 0 to 10.

MIXER

When you've dialled in your preferred settings for the oscillators, you can adjust the individual level of each in the **MIXER** section. The MIXER includes six **ON/OFF switches** and **Volume knobs** for the oscillators, the **external in source**, and the **NOISE generator**.



The ON/OFF switches and volume controls of the MIXER.

For the **EXT IN SOURCE**, there's a volume knob and an **ON/OFF** switch. This lets you use an external sound source connected to the external Input on the rear

panel of the Poly D. Next to the volume knob, there's an **OVERLOAD LED** which indicates if the external input signal distorts. If you want to avoid distortion, turn down the **EXT IN VOLUME knob** until the LED turns off.

NOISE

In addition to the oscillators and the external in source, the MIXER also contains controls for the Poly D's **NOISE generator**. The controls include an **ON/OFF switch**, a volume knob as well as a switch for choosing between **WHITE** and **PINK noise**.

Noise - in this particular sense - is sound containing all frequencies in the audible spectrum. Noise can be generated in two different forms in the Poly D: **WHITE** and **PINK**. In **white noise**, all the frequencies of the audio spectrum have equal intensity. In **pink noise**, all the frequencies of *each octave* of the audio spectrum have equal intensity. Even though white noise contains all frequencies, it is generally heard as high frequency. Due to the way that we perceive sound, the higher frequencies take precedence in how we make out white noise. It has a harsh and bright sound quality to it. Pink noise, by comparison, is more pleasant to the human ear, and has a warmer, wind-like timbre.

The uses of noise in musical synthesis are manifold. It can be used in order to create sound effects, such as wind, thunder and waves, or percussive sounds, such as cymbals and snares. It's also useful to blend noise with the sound of the oscillators, thus creating a richer texture.

4. ENVELOPES and FILTER

This section of the synth comprises the **FILTER** and the **LOUDNESS CONTOUR**. These two parameters are at the heart of subtractive synthesis. With the use of them, you subtract the frequencies and the amplitude of the sound produced by the oscillators. The whole section consists of a number of switches to the left, and a total of nine knobs.



The FILTER and the two envelope generators.

The six top knobs comprise the filter section and the three bottom knobs comprise the loudness contour. Both of these include **envelope generators**. An envelope generator changes the shape of the sound of the oscillators over time. There are two types of envelope in the Poly D: a **filter envelope** and an **amplifier envelope**. The first shapes the sound over time with respect to *frequencies*, while the second shapes the sound over time with respect to *volume*. I think that the

latter type is the more intuitive to understand, so in order to get a grasp of what an envelope does, let's start there.

LOUDNESS CONTOUR

The **LOUDNESS CONTOUR**, then, consists of the amplifier envelope. (Sometimes, this is called a **voltage-controlled amplifier (VCA)** envelope.) As I said above, this shapes the amplitude of the sound over time. More specifically, this is adjusted with three knobs: **ATTACK**, **DECAY** and **SUSTAIN**.



The LOUDNESS CONTOUR.

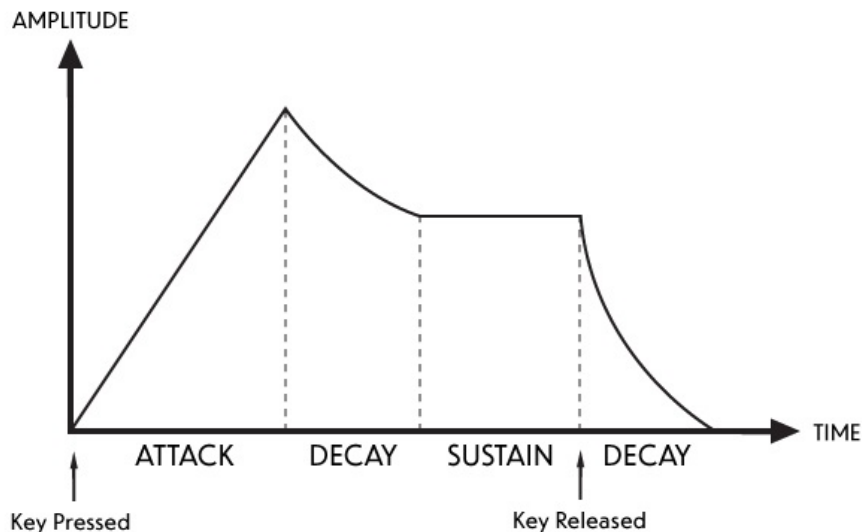
The **ATTACK** knob adjusts how long it takes for the sound to go from zero to maximum volume after we press a key. A fast ATTACK gives a percussive sound, while a slow ATTACK gives a softer sound that gradually increases in volume. The knob is adjustable from 1 millisecond to 10 seconds.

The **DECAY** knob adjusts how long it takes for the sound to go from its maximum level (after the attack phase) to the sustain level. The knob is adjustable from 4 milliseconds to approximately 35 seconds.

SUSTAIN is the volume level maintained until the key is released. In other words, sustain decides the volume level after the attack and decay have settled. The value is adjustable from 0 to 10. Note that while ATTACK and DECAY refer to the *time* it takes for the volume to rise and fall, SUSTAIN refers to the *level* of the volume.

Some synthesizers have a separate Release knob to adjust the time it takes for the volume to reach zero after the key is released. On the Poly D, this is adjusted using the **DECAY switch**, left of the ATTACK knob. If the switch is **ON**, you will get an

additional a decay time after the key is released. The signal will then decay for the time set by the DECAY knob. If the switch is turned to **OFF**, there will be no Decay time after the key is released.



A visual representation of the LOUDNESS CONTOUR.

These knobs might not seem like a big deal. But it's quite remarkable how much you can shape the sound of the synthesizer by using just three parameters. Regardless of your oscillator settings, the LOUDNESS CONTOUR can adjust the sound of the Poly D from a hard-edged rhythmical quality to a soft, gently rising crescendo.

Now that we have a better grasp of the amplitude envelope, let's turn to the filter envelope.

FILTER

Subtractive synthesis basically means shaping the sound of your synthesizer by cutting away frequencies. Another way of putting this is that the frequencies are *filtered*. This is where the **FILTER** section comes in.

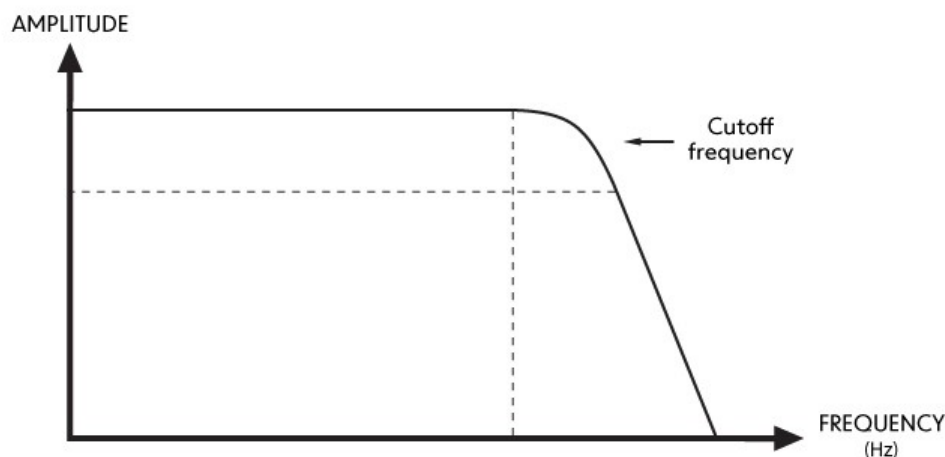
The Poly D has two **FILTER MODES: LO** and **HI**. This decides whether the filter is going to let low or high frequencies pass through. Or, put differently, the **low**

pass filter cuts out the high frequencies from the oscillators and the **high pass filter** cuts out the low frequencies. Once we've chosen our mode, the filter is adjusted with three main knobs: **CUTOFF FREQUENCY**, **EMPHASIS** and **AMOUNT OF CONTOUR**.



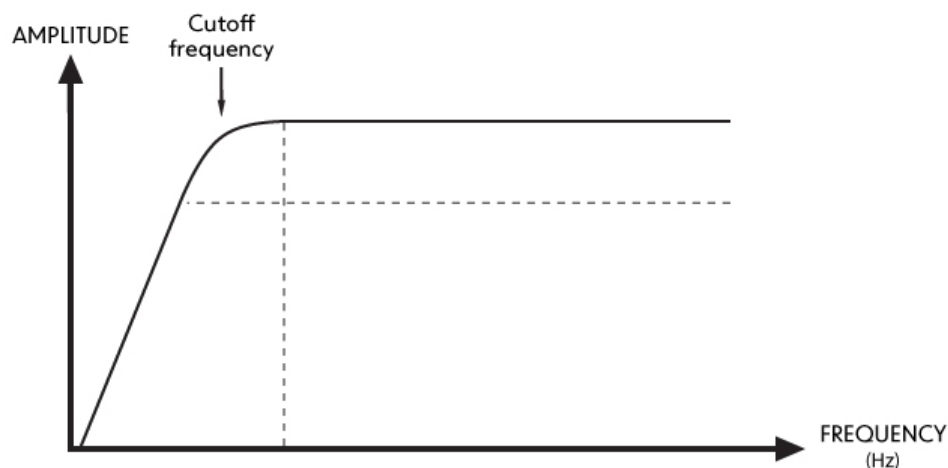
The three filter knobs.

The **CUTOFF FREQUENCY** knob - which is adjustable from -5 to +5 - decides above which point the frequencies will be cut off.



The low pass filter.

If the filter mode is set to **LO**, the higher frequencies above the cutoff point are attenuated. This means that the higher you turn the knob to the right - thus setting the cutoff frequency higher - the higher the frequencies that you allow to pass through the filter. Conversely, a low cutoff frequency in this mode will result in a dark and murky sound.



The high pass filter.

If the filter mode is set to **HI**, the lower frequencies below the cutoff point are attenuated. This means that the more you turn the knob to the left, the lower the frequencies that you allow to pass through. So, a high cutoff frequency in this mode will result in a very bright, treble-heavy sound. A cutoff frequency at +5 in LO pass mode should result in approximately the same sound as a cutoff frequency at -5 at HI pass mode.

EMPHASIS, or resonance, gives a volume boost or amplification of the frequencies at the cutoff point. The level is adjustable from 0 to 10. The effect could be described as an exaggeration of the filter. Generally, more emphasis tends to make the sound more nasal-sounding.

Next, we turn to the **FILTER ENVELOPE**. This makes use of the same envelope principle as we saw in the LOUDNESS CONTOUR section. While the LOUDNESS CONTOUR shaped the volume over time, this envelope shapes the **cutoff frequency** over time. So the filter works in two different stages: first, we adjust which frequencies we want to cut, and second, we adjust how fast we want this setting to affect the sound.

How much of this effect we want is decided by the **AMOUNT OF CONTOUR knob**. (This is sometimes simply referred to as Envelope.) The value is adjustable from 0 to 10. If this knob is set to a low value, the cutoff frequency will be less affected by the filter envelope, and if this knob is set to a high value, the cutoff frequency will be heavily affected by the envelope. If the amount is set to 0, the envelope will do nothing.

There are three knobs which make up the filter envelope. These are the same parameters that affect the loudness contour, namely **ATTACK**, **DECAY** and **SUSTAIN**. These determine the speed and the level of the filter.



The three filter envelope knobs.

The **ATTACK** knob decides how long it takes after a key is pressed, for the cutoff to go from its **lowest** to its **maximum frequency**. The minimum frequency is determined by the CUTOFF FREQUENCY knob and the maximum frequency by the AMOUNT OF CONTOUR knob.

The **DECAY** knob decides how long the cutoff frequency takes to go from its maximum level to the sustain level. This knob also controls the time it takes for the sound to go from its sustain level to zero, once the key is released. This function is enabled by turning the **DECAY switch ON**.

SUSTAIN controls the cutoff frequency level to be sustained as long as the key is held, after the ATTACK and DECAY stages.

While I presented the amplitude envelope before explaining how the filter envelope works, it should be noted that the amplitude envelope is the **last step** in the **signal chain** of the Poly D. The LOUDNESS CONTOUR controls the shape of the volume *after* the audio has already passed through the filter. This means that if

all of the knobs in LOUDNESS CONTOUR are set to 0, the effect of the filter will not be heard, because there is no sound coming through the filter.

KEYBOARD CONTROL

The final aspect of the FILTER that we're going to cover is the **KEYBOARD CONTROL**. This consists of two switches: **1** and **2**; with an **ON** and **OFF** option each. What these two switches do is adjust the filter cutoff in relation to the register you're playing. With both switches turned **OFF**, the cutoff frequency will stay the same regardless of which key you're playing. For example, if you play a high key with a moderate amount of cutoff (e.g. with the knob set to 2), the sound is going to be rather muffled because more frequencies are filtered out the higher you go on the spectrum. The lower you go on the keyboard, the brighter the sound will become, since more high frequencies pass through the filter for the lower notes.

This effect can be neutralized with the KEYBOARD CONTROL. This will adjust the filter so that the cutoff point is moving along with the register of what you're playing. Try playing a high key with the same cutoff frequency as before, and then turning **KEYBOARD CONTROL 1** on. The cutoff frequency will now move to a higher point, thus resulting in a brighter sound.

There are four different options for the KEYBOARD CONTROL:

Switch 1 and 2 OFF - no keyboard tracking effect

Switch 1 ON - 1/3 of the maximum effect

Switch 2 ON - 2/3 of the maximum effect

Switch 1 and 2 ON - maximum effect

5. MODES

In its default setting, the Poly D is a **monophonic** synthesizer. What this means is that it can only play one note at a time. If you hold down a key, and then press another one, the first note will stop sounding and the second will sound instead. As indicated by its name, however, the Poly D has additional capabilities in this regard.

In the CONTROLLERS section, there's a **MODE** switch with three options: **MONO**, **UNI** and **POLY**. These correspond to the **Monophonic**, **Unison**, and **Polyphonic** modes of the Poly D. We shall look at these three in turn.



The three different modes.

The **Monophonic mode** is the standard mode of the synth. As mentioned, this means that you can only play one key, or voice, at a time. Once you press a key, all of the oscillators turned ON will play a note, and when you press a different key, the oscillators will play a different note.

In **Unison mode**, different oscillators can be allocated to play different voices. If you only play one key, the synth behaves just like in Mono mode. But if you play two keys at the same time, two oscillators will be allocated to one note, and two oscillators to the other. (This is of course provided that you have all four oscillators turned on.) If you play three keys, one oscillator will remain inactive, while the others play one note each, and if you play four notes, the four oscillators are allocated to one note each.

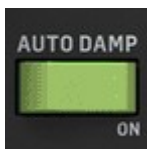
Finally, the **Polyphonic mode** is very similar to Unison, except it only activates one oscillator per key. This lets you play up to four notes at the same time, spread out over different oscillators. Playing one note activates only Oscillator 1, playing two notes activates Oscillators 1 and 2, playing three notes activates Oscillators 1 - 3, and playing four notes activates all four oscillators.

It's important to note, however, that this mode should not be confused with true polyphony. In Poly mode, all the oscillators will still use the same filter and envelopes as set in the FILTER section. For example, if you have a slow attack set in the LOUDNESS CONTOUR, and you press a key, the note will gradually increase in volume. However, if you hold down the first key, while pressing a second one, the sound of *both* notes will now gradually increase in volume, even though you've already pressed the first one. This is because there is only one amplifier envelope, and this envelope will retrigger for each key that you currently press. The same holds true for the filter and its corresponding envelope.

A similar peculiar feature of the Poly mode becomes apparent if you turn up the SUSTAIN level of the LOUDNESS CONTOUR to full and then play a chord. Now release all of the keys but one, and the full chord will still continue to ring. This brings us to the AUTO DAMP function.

AUTO DAMP

Next to the MODE switch, there's an **AUTO DAMP** switch.



The AUTO DAMP switch.

As we just saw, there are some interesting quirks with the Poly and Uni modes with respect to the envelopes and filters. Some of these oddities can be adjusted with the help of the AUTO DAMP function.

If you sustain a note with auto damp **ON**, any new key that is pressed will then be damped if released; only those keys that are still held will continue to sound. If auto damp is **OFF**, all the notes of a chord will continue to sustain until all the keys are released (or a new key is pressed).

This is applicable both in Poly and Unison mode. Turning auto damp ON might be best suited for **mono-style** playing, such as leads and bass lines, with the occasional chord. Having auto damp OFF is best suited for **chords**, when you seldom press single keys while sustaining others. This is less well suited for legato playing, as notes sustain when more than one is pressed down.

6. MODULATION

So far, we've learned how to generate sound using different wave shapes and how we can sculpt this with the aid of the filter and envelopes. This takes us a long way in terms of creative possibilities. But we're still far from exhausting the full potential of subtractive synthesis. Arguably the most versatile way of altering your sound is by modulating the sound of the Poly D using one of five different **Modulation sources**. This is particularly useful when you want to add some "movement" or extra dynamic to your sound, such as vibrato.

In short, modulation in this sense works in the following way. In the CONTROLLERS section, there are two black switches and a **MODULATION MIX knob**. The switches let you choose two of five sources which are then mixed using the knob. Whatever mix you've dialed in is then sent to either one (or both) of two **modulation destinations**: the **pitch** of the oscillators, or the **cutoff frequency** of the filter. The source (or combination of sources) that you've chosen will now modulate the sound of the synthesizer, either in terms of filter or pitch. The **amount** of modulation that you wish to apply to the sound is controlled by the **MODULATION WHEEL**.

Below, I'll go through this process in more detail and then explain the different characteristics of the different modulation sources. First, let's look at the CONTROLLERS section and how to choose between the modulation sources. As I mentioned, there are two source switches.



The different modulation sources.

The left switch displays a choice between **OSC 4** and **FILTER EG**. These refer to **Oscillator 4** and the **filter envelope generator** as modulation sources, respectively. The right switch displays a choice between **NOISE** (or **MOD SRC**) and **LFO**. These refer to using **noise**, or an **external mod source**, on the one hand, and a low **frequency oscillator (LFO)** on the other, as modulation sources.

Once you've chosen either one of two choices per switch, the **MODULATION MIX knob** lets you blend the volume of the modulation sources: OSC 4/FILTER EG on the left and NOISE SRC/LFO on the right. This makes it possible to mix two different modulation sources at the same time, e.g. the LFO paired with Oscillator 4, or the filter EG with noise. This adds an even further dimension to the complexity of modulation.



The MODULATION MIX knob.

The **amount**, or the depth, of modulation is determined by the **MOD wheel**. This is the right of the two wheels in the KEYBOARD SECTION. Rolling the wheel upwards increases the amount of modulation depth, which is reflected by the wheel's increasingly glowing red light. Rolling the wheel downwards until the light is put out turns the modulation effect off altogether.



The modulation wheel.

Before we go into what the actual modulation sources do, let's say something about the modulation destinations. As mentioned, any of the chosen types of modulation can be used either as a means of adjusting the oscillator pitch, or the filter. The former is enabled by turning the **OSCILLATOR MODULATION** switch **ON**. This is located between the CONTROLLERS section and the OSCILLATOR BANK. The latter option is enabled by turning the **FILTER MODULATION** switch **ON**, in the FILTER section. If both switches are ON, the modulation source will modulate *both* the oscillators' pitch and the cutoff frequency of the filter.

Now, let's look at the different modulation sources and their effects.

LFO (LOW FREQUENCY OSCILLATOR)

The LFO is an additional oscillator, but one whose frequencies are so low that you cannot hear them. Instead, the LFO modulates the sound of the Poly D's other oscillators, specifically its **pitch** and **cutoff frequency**. The settings of the LFO are located in the left hand KEYBOARD section and consist of an **LFO RATE knob**, and a **wave shape switch**.

The speed of the LFO modulation is determined by the LFO RATE knob, which can be set with a value from 0 to 10. The **LED** indicates how fast it is going.



The LFO rate knob.

The speed basically refers to how frequently the oscillation of the LFO affects whatever destination it is being sent to. If your chosen modulation destination is the oscillator pitch, then a higher LFO rate will result in the pitch fluctuating faster up and down. If the modulation is applied to the filter, then a high rate will make the cutoff frequency rise and fall rapidly.

How the LFO affects the sound of the Poly D will also be the result of which waveform you apply to it. The black switch next to the rate knob lets you choose between two different waveforms: **triangle** and **square**.



The LFO waveform shapes.

Naturally, the waveform of the LFO controls the shape it uses to modulate the sound. Since we cannot hear the LFO itself, there is no timbre to be affected. But because the frequencies of the LFO are so low, we can actually *hear* the shape of the wave form. Try setting the rate to slow and the destination to the filter. The triangular shape results in the cutoff frequency give gradually rising and falling. If you instead use the square wave, the filter effect will come and go in a sharp, binary form. The same applies to oscillator pitch: the triangle shape makes the pitch gradually increase until it then gently decreases in a similar downward motion; the square shape sharply raises the pitch and then lowers it, in even on/off intervals.

Finally, the **amount** (or depth) of LFO modulation is adjusted (like all modulation sources) with the **MOD wheel**.

NOISE

The second type of modulation is **noise**. This is selected by switching the modulation source switch to **NOISE (MOD SRC)**. (The setting for selecting the noise source is the same as for setting the external mod source option. More on that below.) In a nutshell, you use the noise generator of the MIXER section to modulate either pitch or cutoff frequency. This gives the modulation an even texture, which slightly varies depending on whether you select white or pink noise. You can still use the noise generator in its own right, even though you're also using it as a modulation source.

FILTER EG (ENVELOPE GENERATOR)

The third type of modulation is the **Filter Envelope Generator**. What we're doing here is using the filter envelope to modulate the oscillator pitch. The character of the modulation will thus be determined by the shape of the filter envelope. Thus, the attack, decay, and sustain settings will determine how quickly (and at which level) the pitch rises and then falls.

(The filter envelope as a mod source can in principle also be used to modulate the cutoff frequency of the filter. But since the filter is naturally already affecting the cutoff, there is no radical difference if you apply the Filter EG as a mod source on top of this.)

OSC 4 (OSCILLATOR 4)

As we saw above, the settings of the LFO were rather limited. In its place, Oscillator 4 can be used as an additional modulation source with further options. For example, it has added frequency ranges and more wave shapes than the LFO does.



Oscillator 4.

After we've chosen Oscillator 4 as our modulation source in the CONTROLLERS section, we can set the **frequency** of the oscillator to **LO**. This means that we stop using it as a sound source and that it only generates so low frequencies that it acts as a low frequency oscillator. This basically works the same way as for the LFO; the rate of the modulation is set by the **fine tuning knob** and the **WAVEFORM switch** lets you select your preferred waveshape. The biggest difference here is that we get more choices in terms of the shape that the modulation takes.

In addition to the triangle and square shapes which were available for the LFO, we now also get reverse sawtooth, sawtooth, medium pulse and narrow pulse. The **reverse sawtooth** shape gives the modulation oscillation a sharp ascent, followed by a gradual descent. The regular **sawtooth** shape is the inverse of this: it gradually rises until it reaches the top and then suddenly falls straight down. For this reason, the two sawtooth shapes are also called **ramp down** and **ramp up**, respectively. The **medium** and **narrow pulse** width modulates the sound sharply upwards, then remains constant for a short period of time (how long is determined by the width of the pulse) before it sharply falls again.

In addition to using Oscillator 4 as a straight LFO, you can also use it as a modulation source while using it as a sound source in its own right. Select the frequency range to anything else except for LO (and turn the sound of the oscillator **ON**) and you will now be able to hear the sound generated by the oscillator in addition to hearing it as a modulation source.

One final aspect of Oscillator 4 as a modulation source is the **OSC 4 CONTROL** switch located to the left of the RANGE knob. This switch disconnects Oscillator 4 from the keyboard, thus making the keyboard play a constant frequency. This basically works the same way as the keyboard control switches in the FILTER section. If we don't disconnect the keyboard, Oscillator 4 as an LFO will move faster the higher you move up the keyboard. Since disconnecting the keyboard makes the frequency of the oscillator constant, it will have the same speed regardless of where on the keyboard you're playing.

MOD SRC

The fifth and final modulation source available in the Poly D is the **external mod source input**. As we saw above, this is chosen using the same setting as when you select noise as a modulation source. In this setting, the external mod source is activated by plugging in your desired external source in the **MOD SOURCE input** jack. This will then replace noise as a modulation source.

Connecting external devices to the Poly D in order to use them as modulation sources further expands the possibilities of creating sounds with the synth. One example of an external source is using an LFO from a different synthesizer.

7. DISTORTION and CHORUS

The Poly D comes with two internal effect generators: **distortion** and **chorus**.

DISTORTION

The DISTORTION section consists of an **ON/OFF** switch and three knobs, adjustable from 0 to 10.



The DISTORTION section.

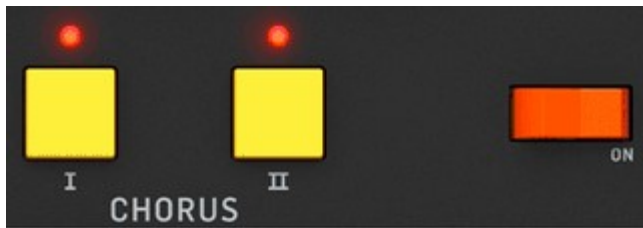
The **DISTORTION LEVEL knob** adjusts the **amount** of distortion.

The **TONE knob** adjusts the **frequency** of the distortion. A higher level of tone produces a brighter sound, while a lower level produces a darker sound.

The **LEVEL knob** adjusts the **output level** of the distortion. Note that this heavily affects the overall volume of the synth as well.

CHORUS

The **CHORUS** section consists of an **ON/OFF** switch and two buttons: **I** and **II**.



The CHORUS section.

Chorus I activates a lighter chorus effect, while **II** activates a heavier effect. **I** and **II** can also be combined to create an even more pronounced effect.

Note that the chorus is a **stereo** effect, which makes it the only feature of the Poly D to be in stereo.

8. SEQUENCER and ARPEGGIATOR

The Poly D comes with both a dedicated **sequencer**, and an **arpeggiator**. These are both controlled in the **SEQUENCER/ARPEGGIATOR** section. The sequencer lets you program and play back patterns of up to 32 steps of notes. The arpeggiator plays the notes that you are holding down on the keyboard.

Let's start by looking at the sequencer and then turn to the arpeggiator.

SEQUENCER

The Poly D has a 32-step sequencer with the ability to edit gate length, add ratchets, accents, glides, rests, and ties. It can also store up to 64 patterns in total, divided in 8 different memory banks, holding 8 patterns each. The sequencer is controlled using a set of menu buttons, two rows of LEDs and a tempo knob.



The sequencer/ARP menu buttons, the arrow buttons, and the LOCATOR LEDs.

You'll find the main menu buttons to the left. To the bottom right of these, there are two further **arrow buttons**. In addition, there are two rows of 8 LEDs each. The ones to the left are the **LOCATOR LEDs**, and the one to the right are the **STEP switch LEDs**. The latter LEDs also function as buttons.



The 8 STEP switch LEDs.

Finally, there's the **TEMPO** and **GATE LENGTH knob**.



The TEMPO/GATE LENGTH knob.

I will start by breaking down how to record, play and save a pattern, before going into details about editing features of your pattern. Note that there are two main modes of the sequencer: **KEYBOARD mode** and **STEP mode**. You switch between these by holding down **SHIFT**, and then by pressing **<KYBD or STEP>**.

RECORDING A PATTERN

First, ensure that you're in **KEYBOARD** mode. Then, by pressing the **REC** button, you enable the **Recording mode**. This is indicated by a flashing light on the **STEP 1 switch LED**. For each key you press, one of the steps of the sequencer will register a note, and the next **STEP switch LED** will light up.

Note, however, that the pattern is not yet saved. You can still continue to add or overwrite steps of your pattern while in Recording mode. If you wish to abort a recorded pattern, press **PATTERN + RESET**. This will reset the sequencer pattern. Exit the Recording mode by pressing **REC** again.

PLAYING A PATTERN

Once you've recorded your pattern, you can play it back by pressing the **PLAY/STOP** button. The **HOLD/RESET** button resets the pattern to step one. The tempo of the sequencer is set by the **TEMPO/GATE LENGTH knob**. By turning it, you increase the tempo from 0 to 10.

The sequencer has 8 visible steps as indicated by the **STEP switch LEDs**. But each pattern can hold up to 32 steps. If you've recorded 8 steps and keep adding steps, the sequencer will automatically skip to the next **page**, which will be indicated by the **LOCATION LEDs**. Once you've filled up 8 more steps, the sequencer will turn to yet another page, and so on, until you reach page 4, or 32 steps are filled.

SAVING A PATTERN

Once you've recorded a pattern that you want to commit to memory, hold down **SHIFT + PLAY/STOP** for 2 seconds to enable the **Save mode**. The **LOCATION LED** should now be flashing in **green**, thus indicating where the pattern will be saved. Choose your preferred **pattern number** 1-8, either by using the **arrow buttons** or the **STEP switches**. Choose your preferred **bank number** by holding **BANK + PATTERN** and then by pressing your desired number among the STEP switches. In order to save the pattern in the current location, press **SHIFT + REC**. The LED should now stop blinking as you exit the Save mode.

An alternative way of saving your patterns is by choosing a preferred save location beforehand. First, hold down the **PATTERN** button and navigate to a particular pattern and bank number. Second, record a pattern using the regular procedure. Third, enable the save function by pressing **SHIFT** and then **PLAY/STOP** for 2 seconds. Finally, hold **SHIFT** while pressing **REC** in order to save your pattern to the selected location.

Yet another way of saving patterns is by connecting the synth via USB to a computer.

If you wish to erase a saved pattern, navigate to the location of the pattern and then press **SHIFT + RESET + PATTERN**.

Note that all the features of your pattern (except for tempo), such as swing, rests, gate length, and so on, will be saved with the pattern.

BANKS

Once you've saved a number of patterns, it might be necessary to navigate through the different **banks** of the sequencer to load your patterns. The sequencer has 8 banks, which in turn stores up to 8 patterns each. By holding the **PATTERN** button down, the LOCATION LEDs will indicate (in green) which pattern is the current one. By holding the **SHIFT + PATTERN** buttons, the LOCATION LEDs will indicate (in orange) which bank the current pattern is saved to.

As indicated above, you can scroll through the patterns by holding the **PATTERN** button and then pressing **STEP switch** 1 to 8, or by holding **PATTERN** and then navigating using the left/right arrow buttons. You use the same procedure to scroll through the banks, with the exception that you need to hold down **SHIFT** in addition to **PATTERN**. So, you select a different bank by holding **SHIFT and PATTERN** while pressing **STEP switch** 1 to 8, or by doing the same and then navigate using the left/right arrow buttons.

EDITING THE PATTERN

I've now shown the main recording, playback and save functions of the sequencer. Let's turn to some features that you can add to your pattern once you've recorded it. Hold down **SHIFT** and select any step in your pattern among the **STEP switch LEDs**. The selected step will start to flash, and you're able to add a rest, an accent, a tie, and more features described below. In order to deselect a step, simply press **SHIFT** and the key you've selected again.

An alternative way of editing a pattern is by pressing **REC** in **Keyboard mode**. This will light up the **STEP switch LEDs**. Now, follow the same procedure as above, by pressing **SHIFT** and the **STEP switch** of the step you want to edit. Press **REC** to exit this mode. (If there are more than one page to your pattern, use the **PAGE** button to navigate to your preferred page. The **LOCATION LEDs** show which page you are on.) You can also always edit the steps of your pattern as they're selected when recording them.

Once you've selected the step you wish to edit, the following features can be added.

SWING

If you hold **SHIFT** and turn the **SWING knob**, you'll edit the **Swing** of your pattern. Notice how the LEDs react to the swing effect in a bright green light from 1, which is no swing, to 8 which is the maximum effect. Once you've adjusted the swing, you will have to adjust the tempo to what you had before.

GATE LENGTH

There's a default length to each step in the pattern we create. This can be edited by adjusting the **Gate length** of the steps. Once you've selected the step you wish to edit, turn the **TEMPO/GATE LENGTH** knob to your desired gate length value. The **LOCATOR LED** lights will now indicate how long the length of the steps will be, from 1 to 8. 8 means that the note is **tied** to the next step. If two or more steps are tied, it means that the envelope will not re-trigger after the first step. If the note after the first is the same, it will be made longer instead.

GLIDE

In order to add a **Glide** effect between steps, select the step from where the glide should start and then turn the **GLIDE knob** in the CONTROLLERS section, until the number 5 in the LED LOCATION lights turns on. It's activated if you go above the value 5 and deactivated if you go below 5. However, in order to hear your glide in playback, you must also activate the global glide function using the GLIDE knob. Note too, that if your gate length is set too short, it will be hard to hear the glide effect.

RATCHETS

You can also add **ratchets**, which means triggering the envelopes several times in the space of one step. To apply ratchets to a selected step, hold **SHIFT** and then turn the **GLIDE knob**. As you turn the knob, the LED lights will turn yellow and indicate a value of 1-4. These numbers correspond to the number of times that the envelopes are triggered in that particular step. The LOCATION LED number 6 will light up once the ratchet has been applied. Note that, as with the glide function, if your gate length is too short, it will be hard to hear the ratchet.

ACCENTS

The **ACCENT** button adds an accent to your selected step, which will be indicated by the LOCATOR LED 8 lighting up. You can also do this while recording by first pressing **REC**, holding the key you want to be accented, and then pressing the **REST/ACCENT** button. The number 7 LED should light up, and you can then release the key.

RESTS

Insert a **Rest** to a selected step by pressing the **HOLD/REST** and the LOCATOR LED 8 should light up. The sequencer then skips one step in the pattern. Remove the rest by pressing the **HOLD/REST** button again.

TEMPORARY EDITS

There are some additional, **temporary** edits that you can add to your pattern in Playback mode. These will not be saved with the pattern. In order to add **ratchets** to each of the steps of your pattern, press **SHIFT** and then turn the **GLIDE knob**. The effect will stop when you release SHIFT. To add **accents** to all steps, hold **SHIFT** and then press **RESET/ACCENT**. In order to **mute** the whole pattern, press **SHIFT + HOLD/REST**. You can also mute individual steps by pressing the SWITCH step LEDs. Finally, there's a feature where you **transpose** the pattern as it's playing by pressing a key on the keyboard.

REVERSE MODE

In KEYBOARD mode - while the pattern is playing - you can **reverse** the playback of the sequence by pressing the **<KYBD button**. This plays the pattern backwards. Another way of doing this is if you hold **SHIFT** and press **PLAY/STOP**. Reset the Reverse mode either by holding **SHIFT** and pressing **PLAY** again (which will stop the playback), or press **STEP>** (which will continue the playback, but without the Reverse mode).

ADDITIONAL PLAYBACK FUNCTIONS

By default, the **PLAY/STOP** button will automatically play through each of the pages of your pattern. Another way of scrolling through pages is by pressing **PAGE**. Your position will then be locked to the current page. Pressing **PAGE** again will skip to the next page. To exit the **Page mode**, hold **SHIFT** and press **PAGE**. This will make the sequencer return to automatic page turning.

In playback mode, the end step of your recorded pattern is indicated by a flashing light among the STEP switch LEDs. In order to change this, hold **SHIFT** and **ARP/SET END**, and then press your preferred end step among the **STEP switch LEDs**. You can also do this using the same procedure in STEP mode.

Lastly, you can **offset** the sequence by a step if you press **STEP** in **STEP mode**.

LIST OF COMMANDS

In summary, here is a list of the different commands for the sequencer.

Recording mode	REC
Abort recorded pattern	PATTERN + RESET
Save mode	SHIFT + PLAY/STOP for 2 seconds
Save pattern	[IN SAVE MODE], press SHIFT + REC
Change pattern save location	PATTERN + < or > / STEP switch 1-8
Change bank save location	SHIFT + PATTERN + < or > / STEP switch 1-8
Delete saved pattern	SHIFT + RESET + PATTERN
Select step	SHIFT + < or > / STEP switch 1-8
Add Swing	SHIFT + SWING knob
Edit Gate length	[SELECT STEP], TEMPO/GATE LENGTH knob
Add Glide	[SELECT STEP], turn GLIDE knob
Add Ratchets	[SELECT STEP], press SHIFT + turn GLIDE knob
Add Accent	[SELECT STEP], REST/ACCENT
Add Rest	[SELECT STEP] + HOLD/REST
Add Ratchets to all step	SHIFT + turn GLIDE knob
Add Accents to all step	SHIFT + RESET/ACCENT
Mute step	SWITCH step LED 1-8
Mute pattern	SHIFT + HOLD/REST
Offset the pattern by one step	[In STEP mode], press STEP>
Reverse sequence	SHIFT + PLAY/STOP, or <KYBD
Page mode	PAGE
Exit Page mode	SHIFT + PAGE
Enable KEYBOARD mode	SHIFT + <KYBD
Enable STEP mode	SHIFT + STEP>

Hold current step	HOLD/REST
Return to step 1	RESET/ACCENT, while playing a pattern
Change pattern number	PATTERN + STEP switch 1-8, or <KYBD / STEP>
Change bank number	SHIFT + BANK + STEP switch 1-8, or <KYBD / STEP>
Change end step	SHIFT + ARP/SET END + STEP switch 1-8

ARPEGGIATOR

The **ARPEGGIATOR** is similar to the SEQUENCER in that it lets you program and playback patterns of your choice. The difference is that the sequencer can record patterns using the keyboard in a stepwise fashion while the arpeggiator plays only those notes that you hold. This makes the arpeggiator far easier to use and can be a preferred choice if your pattern is a simpler, repeated pattern.

Enable the arpeggiator by pressing the **ARP** button. In the default mode, the arpeggiator plays the keys that you're holding down, thus creating an arpeggio. Once you release the keys, the arpeggio will stop. If you press **HOLD**, the arpeggio of the pressed keys will continue playing. Pressing a new combination of keys will play these instead, thus creating a new arpeggio.

You adjust the tempo of the arpeggio just like with the SEQUENCER, by turning the **TEMPO/GATE LENGTH knob**. Similarly, when you turn the same knob while holding the **SHIFT** button, you will instead change the **gate length** of the arpeggiator. The effect that this has will of course also depend on your settings for DECAY and SUSTAIN of the LOUDNESS CONTOUR.

You can add an **accent** to your arpeggio by pressing the **RESET/ACCENT** button while the arpeggiator is playing.

By default, the arpeggiator will play your arpeggio from the lowest to the highest note. But there are a set of patterns you can choose from. You do this either by holding **SHIFT** and pressing the numbers 1-8 of the **STEP switch LEDs**, or by going right or left on the **arrow buttons**. There are eight different arpeggiator patterns:

1. The pattern is played from lowest to highest note.
2. The pattern is played from highest to lowest note.
3. The pattern is played from lowest to highest, and then down again.
4. The pattern is played in random order.
5. The pattern is played from lowest to highest note, and is then repeated one octave higher
6. The pattern is played from an octave higher and goes down to the starting note.
7. The pattern is played from lowest to highest note, and is then repeated one octave lower.
8. The pattern is played from highest to lowest note, and is then repeated the pattern one octave lower.

9. LINKS

Below, I've compiled a list of links that might come useful for the Poly D player.

BEHRINGER LINKS

Behringer Poly D.

<https://www.behringer.com/behringer/product?modelCode=0722-AAJ>

The Poly D on Behringer's Product website.

Poly D Quick Start Guide.

https://mediadl.musictribe.com/media/PLM/data/docs/P0D9J/QSG_BE_0722-AAJ_POLY-D_WW.pdf

Behringer's own Quick Start Guide for the Poly D.

Wheels and Aftertouch Calibration Guide.

https://mediadl.musictribe.com/media/PLM/data/docs/P0D9J/User-Support-Bulletin_POLY-D_Calibration-Wheels-And-Aftertouch-Guides.pdf

Calibration procedures for recalibrating the Poly D's pitch wheel, mod wheel and aftertouch.

Oscillator Calibration Guide.

https://mediadl.musictribe.com/media/PLM/data/docs/P0D9J/User-Support-Bulletin_POLY-D_Oscillator-Calibration.pdf

Calibration procedure for recalibrating the Poly D's oscillators.

Synthtribe Download for Mac.

https://mediadl.musictribe.com/download/software/behringer/synthTool/SYNTHTRIBE_V2.7.4-Mac.dmg

Download link for the Synthtribe software for Mac.

Synthtribe Download for Windows.

https://mediadl.musictribe.com/download/software/behringer/synthTool/SYNTHTRIBE_V2.7.4-Windows.zip

Download link for the Synthtribe software for Windows.

OTHERS**Minimoog Model D Manual.**

https://api.moogmusic.com/sites/default/files/2018-01/Minimoog_Model_D_Manual.pdf

Minimoog Model D manual, including 42 patches.

Behringer Model D Patches on Patch-library.net.

https://patch-library.net/patches?device=behringer-model-d&fbclid=IwZXh0bgNhZW0CMTAAR0luiHslWNrmbJEEp4zadqcqGJAZES37Wr4af1NJDlWo0QAf9k7NDPTAoo_aem_ZmFrZWR1bW15MTZieXRlcw

User-created patches for Behringer's Model D synthesizer.

Behringer Model D Patches on Presetpatch.com.

<https://www.presetpatch.com/synth/behringer-model-d>

More user-created patches for Behringer's Model D synthesizer.

Minimoog Patch Book.

<http://www.synthzone.com/midi/moog/minimoog/MINIMOOG%20PATCH%20BOOK.pdf>

A patch book with 52 patches for the Minimoog Model D by Tom Rhea.

Minimoog Model D Patches on Presetpatch.com.

<https://www.presetpatch.com/synth/moog-minimoog>

User-created patches for Minimoog Model D.

Recreating 5 Classic Minimoog Model D Synth Sounds.

<https://reverb.com/news/video-the-synth-sounds-of-5-classic-minimoog-tracks>

Article on Reverb.com with video and patch sheets for 5 classic Minimoog Model D sounds.

Behring Poly D Patch Saver.

https://ctrlr.org/behringer-poly-d-patch-saver/?fbclid=IwZXh0bgNhZW0CMTEAAR05BXNRzt9ylsssfWhGt0aHcDCLg2IT628yJuntNBVFDzXQqDI3VxOSqwE_aem_ZmFrZWR1bW15MTZieXRlcw

A patch saver software for mapping patches for the Poly D.